

# MONTHLY NOTICES

OF THE

## ROYAL ASTRONOMICAL SOCIETY.

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WILLIAM HUGGINS, ESQ., F.R.S., President, in the Chair.

Robert C. Carrington, Esq., Indian Marine Survey, Calcutta;

Alexander Davidson, Esq., Addison Lodge, Ridgway Place, Wimbledon;

Thomas Gregory, Esq., Merchants' College, Blackpool;

Lieut. F. W. Jarrad, R.N., Deputy Superintendent, Indian Marine Survey; and

Dr. A. K. Rollit, LL.B., B.A., Sheriff of Hull, President of the Royal Institution, Hull, 18 Trinity House Lane, Hull;

were balloted for and duly elected Fellows of the Society.

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*Mr. David Gill's Expedition to Ascension; Correspondence and Reports.*

*Downing Street, August 20, 1877.*

MY LORD,—I am directed by the Earl of Carnarvon to transmit to you, with reference to your letter to Mr. Lowther of the 9th June, a copy of a despatch from the Governor of St. Helena relating to the possibility of taking astronomical observations on that island.

I am, my Lord, your Lordship's obedient servant,

JOHN BRAMSTON.

Lord Lindsay, M.P.

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*Governor Janisch to the Earl of Carnarvon.*

(COPY.)

[No. 33.]

*St. Helena, July 7, 1877.*

MY LORD,—I have the honour to report that Mr. D. Gill, referred to in your lordship's despatch No. 73, arrived at this island on the 1st instant, and it gave me much pleasure to afford him all the assistance I could.

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2. It is a matter of great regret to me that his arrangements require him to proceed to Ascension for the proposed observations, instead of making them at St. Helena, the position of which is so perfectly adapted to the observation of *Mars* in its present southern declination.

3. Mr. Gill himself shares in this regret, and informs me that it was at first intended to select St. Helena for the purpose, and that the alteration in the plan was caused by a mistaken supposition that the atmosphere of this island was too cloudy to be favourable. This opinion was founded upon published meteorological observations made at Longwood; and it was not until his arrival here that Mr. Gill became aware, from his own observations, that the clouds which prevail at Longwood and other elevated positions to windward do not usually extend to James' Town and the leeward side of the island.

4. I have mentioned this circumstance in the hope that, looking to the approaching transit of *Venus*, a similar mistake may not prevent astronomers from availing themselves of the advantages offered by the position of this island.

I have &c.,

(Signed) HUD. R. JANISCH.

Right Honorable the Earl of Carnarvon, &c. &c. &c.

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*Mr. Gill's Reports: Preliminary Report, dated August 15, 1877.\**

I beg to forward to you, as President of the Royal Astronomical Society, the following report of my doings up to the present date.

Accompanied by my wife, I left London on the 14th June, taking with me the chronometers of the expedition, received the same day from Greenwich, and the following day at noon sailed from Dartmouth, and reached St. Helena on the morning of Sunday, the 1st July. Instruments and baggage were safely landed; and, thanks to a despatch from Lord Carnarvon to the Governor, procured through the kindness of Lord Lindsay, comfortable lodgings were ready for us, and accommodation for the more delicate instruments was provided in the Castle. The heavy packages, houses, &c., were stored by Messrs. Solomon, Moss, Gideon, & Co., agents for the Donald Currie line of steamers. Captain S. T. Olliver, R.A., kindly offered the services of some of his gunners to carry such instruments as I desired to the site of Johnstone's Observatory (Ladder Hill)—now the Artillery and Engineer mess-room; and, as I wished to make a chronometric connection between Ascension and St. Helena, I gladly availed myself of this offer. On Monday (July 2) the chronometers and reflecting circle were conveyed there; and altitudes of the Sun,

\* To prevent a possible misunderstanding of expressions in these Reports, it is right to mention that the Expedition was undertaken only in part at the costs of the Royal Astronomical Society.—Ed.

morning and evening, were observed for time. Similar observations were repeated frequently during my stay on the island; the chronometers were wound and intercompared daily.

During my stay on the island, I visited Halley's Mount, and discovered what undoubtedly has been the site of Halley's Observatory. An oriented foundation of a building still exists, overgrown by ironwood scrub (called on the island wild pepper), and near the observatory are evidently the remains of a quarry, whence the stones for its erection have been taken.

Halley does not appear to have selected the best site on the island as to meteorological conditions; at least, in the present day Ladder Hill is very much better.

To windward the island rises very abruptly nearly to its greatest height, and it is a very curious and interesting sight to watch the mountain ridge from a point near Diana's Peak, when the dew-point of the approaching trade current is a little below that of the temperature of the ridge.

Out to windward the sky is clear and blue, and so it remains over Sandy Bay (the low land between the ridge and the sea). Twenty or thirty yards below the crest of the ridge, and perhaps a hundred yards seawards, the cloud suddenly forms like a grey mist, rolls over the crest, and becomes thicker and blacker, depositing itself in rain as it passes over the high land, and then, as it descends to the lower land, it dissipates in the higher temperature, and over Ladder Hill all is again clear blue sky.

I found that Sabine's observations made at Longwood (nearly the most cloudy part of the island) did not at all represent the amount of cloud at Ladder Hill; and the reasons will be evident from the illustration I have given.

As night after night showed clear blue sky, and conditions generally favourable for astronomical purposes, I could not but regret that my pledges to the Society prevented my settling down here without incurring the further anxiety and risk of transshipping so much delicate apparatus. This regret was much increased by the great sympathy and assistance I should have received from the Governor. He is himself an enthusiastic amateur in astronomy, would have afforded every assistance in erecting the Observatory, and would himself have undertaken the time determinations.

On the afternoon of July 10 we left St. Helena, and on the morning of July 13 reached Ascension.\* Two flags exhibited at the pier-head indicated that "double rollers" were in and that landing was dangerous; but we learned that preparations had been made to receive ourselves and baggage on board H.M. Supply Ship *The Industry*. Fortunately this became unnecessary, the rollers abated somewhat, we got safely ashore, our goods being placed in a large lighter, ready to be landed when the rollers would permit, and this was fortunately accomplished the

\* It will be necessary to procure the Admiralty Chart of Ascension (surveyed by Lieut. Bedford, R.N.), 1838, to understand this Report.

same evening. During the day I was busy inquiring as to a site. In answer to my questions about cloud, the reply of everyone was: "There is far too little of that; you will have no trouble from cloud," and so forth.

I knew that whatever cloud we might expect would probably be chiefly due to Green Mountain; it was generally cloud-capped, and so it was that day. I was told that often it was so, but that this cap of cloud simply remained there and did not affect the purity of the rest of the sky.

The house provided for our accommodation (photograph 1 enclosed) is situated in "Garrison" (George Town on the map), and "Garrison," excepting the Sanatorium "up the Green Mountain," is the only inhabited part of the island. To go "up the mountain" amongst the clouds was of course absurd; to get any point to windward\* or south of Green Mountain I was told was impossible, because the lava was impassable by land, and there were no landing-places on the island where instruments could be put ashore excepting the pier-head and Comfortless Cove to the north of Garrison.

Garrison appeared to be, then, the only site, and exactly opposite our house—not twenty yards from our door—is what is called the "croquet ground," a large levelled space paved with concrete; and here I had all the baggage carted on the morning of July 14.

Notwithstanding a kind invitation from Captain Phillimore to spend a few days with him till we could get our house in order, we took up house at once, so as to be on the spot; and with the assistance of some blue-jackets and marine artificers, the Observatory (photograph 2) was erected in a couple of days.

At the end of five days all the instruments were established in perfect adjustment, with a distant meridian mark to the south, and a mark in focus of a long focus-lens as collimator to the north for the transit. The whole was as complete and comfortable as could be desired. For the first few nights after our arrival the sky was beautifully clear; but hardly were the instruments adjusted when cloudy weather set in and completely upset all my hopes of obtaining a series of observations of *Ariadne*.

After some vain attempts I was reluctantly compelled to give up the *Ariadne* investigation, and commenced the triangulation of the *Mars* stars of comparison, and for some days with considerable success.

Though the evenings and mornings were cloudy, still it was possible for some time to secure observations not far from the zenith, and in this way, by much labour and watching I was able to go over most of the principal triangulations once. Matters however got worse and worse, and I began to fear that some persistent cause was at work, and that the opinions I had gathered as to the weather were not trustworthy.

\* Being in the trade-wind, this is S.E.

Everyone declared that such a period of cloud had never been before observed; but it appeared to me that much of it was due to local causes. I observed frequently that whilst we had a band of cloud across the zenith, the horizon to north and south, particularly to south, was often clear.

The band of cloud undoubtedly came from Green Mountain, was carried over Garrison and out to sea; the point was, would it be possible to get south of this cloud, and, if possible, could an observatory be erected and maintained there?

Captain Phillimore, while warning me of the difficulties attending any change in the site of the Observatory, volunteered in the kindest manner to assist in every possible way, not only in any change I might desire to make, but also in the search of a site. The night of Monday, July 30, was typical of many that had gone before, and, that I might not lose any opportunity of observing that might occur, my wife volunteered to make the necessary observations. Accompanied by two servants, she set off at 10 P.M. and walked as far south as possible, making simultaneous observations with me at previously arranged instants. These observations were continued from 10 P.M. to 3 A.M. at each half-hour, and from these I was enabled to draw definite conclusions as to the cause and position of the cloud band.

These conclusions were briefly as follows:—

1. In certain conditions of the trade-wind the effect of the Green Mountain resembles the effect of introducing a lump of soft clay in a stream of clear water—a broad band of cloud is produced, which passes over the island in the direction of the wind. The cloud begins somewhat to windward of the peak.
2. The south limit of this stream of cloud passes nearly vertically over the south limit of “South-West Plain,” about as far as “Round Hill.” To clear this cloud it was evident that a point near the south limit of the island must be occupied, and also pretty far east, so that the cloud which may form windward of Green Mountain shall subtend the smallest possible angle.

The following day Captain Phillimore and I set out to explore. From South Gannet Hill we saw the small bay shown (unnamed) on the chart, due south of Saddle Crater, and one of the watercourses seemed to render it possible to reach this bay from the land side. It is impossible to describe the extraordinary character of this lava, but I hope to send some photographs of it by next mail; except in the beds of watercourses, it is quite impassable—the lava is so rugged and so sharp. Locally it is called “clinker.” We reached the bay, and, after close examination, Captain Phillimore believed instruments could be landed on a smooth day. At the extreme north-east corner of the bay there is a little sandy beach, and the projecting rocks seemed entirely to protect it from the swell from the south-east. The official report in the hands of the Admiralty states that there is *no* landing place here, and the bay is not in sight of any signal station. Captain Phillimore was convinced of the justness of his conclusions, and undertook the



responsibility of the landing, and when my friend Lieutenant Hammich, commanding H.M.S. *Cygnets*, undertook to give me Kroomen to carry the heliometer tube by land, I resolved to dismantle the Observatory the following day. That night (July 31) I obtained a fine set of evening and morning observations of *Mars* and comparison stars, and was strongly tempted by kind advisers to let well alone, and take my chance of some clear nights rather than incur the risk, anxiety, and labour of another transport and erection. I had, however, already weighed all these chances, and, accordingly, when the men arrived on Wednesday morning, we set to work, and by the same evening, with the aid of a considerable force of men, all the instruments and houses were dismantled, repacked, and stowed in a large lighter moored near the quay. At sunrise next morning (Thursday, August 2), the lighter and some small boats were towed round by a steam tug to our bay, now called Mars Bay. The day was unusually fine, and, under the skilful personal superintendence of Captain Philimore, all the instruments, houses, &c. were safely landed without a scratch. Friday and Saturday were occupied in re-erecting the Observatories and instruments, and on Saturday evening the heliometer was adjusted, and, but for excessive personal fatigue, I might have obtained morning observations of *Mars*. On Sunday, August 5, I obtained good evening and morning observations of *Mars*.

During the day of the 5th August I found that, without some special arrangements, life would be unsupportable at Mars Bay, from flies, sandbugs, and other insects. I therefore returned by land (walking over the clinker) to Garrison, to procure carbolic acid, mosquito curtains, and other protections from insects, and returned the same night to make observations.

I had the misfortune to strain a tendon in my knee-joint (an old weakness), and reached Mars Bay, feeling very ill, and in considerable pain.

The night was fine, but when I attempted to observe I could not see, and was unable to stand. I sent for a doctor next day, who came and had me carried over the clinker by men, and conveyed to Garrison, where he found I was knocked up by exposure, anxiety, and fatigue, and was suffering from a local fever called the "Roller Fever." He promised I should be well in three days if I would place myself in his hands. Accordingly, on Friday the 10th, I was able to return to work, and secured morning observations of *Mars*. On Saturday the 11th we had rain, and after the early evening persistent cloud. I shall add at the end of this report what weather we have up till mail goes.

I can only now say that I have an Observatory here complete in all points. Complete arrangements have been made for the regular supply of food and water from Garrison, and such provision made for my own comfort as, I believe, will enable me to live without much loss of health. The best possible site in the island, in an astronomical point of view, has been secured, and we

can now only wait for such weather as the trade-wind brings. The observations secured seem to be good; at least, the observer, in making them, has the satisfactory feeling that he is measuring a well-defined satisfactory object. The character of the definition is much more crisp and sharp, and the images are more steady here than in Garrison; and I look forward to a satisfactory determination of the parallax, if Providence sends me health and fine weather.

The following observations of *a Centauri* may be interesting to astronomers who are engaged on the orbit of that interesting binary.

*a Centauri.*

	P. Angle.	Weight.	
1877.	°		
July 22	69 25	$\frac{1}{2}$	$\left. \begin{array}{l} \text{Distance about } 2''.0 \text{ or } 2''.1. \\ \text{I defer a more exact value till I} \\ \text{have completed a reinvestigation} \\ \text{of the screw.} \end{array} \right\}$
27	80 35	2	
28	75 17	1	
Aug. 5	80 33	2	

*August 15.*

Two additional morning observations of *Mars*, and one additional evening observation, have been secured: that is, in all, four evening and five morning observations. Much has been done within the past two days to render life comfortable; roads have been made, and the neighbouring patches of lava-dust covered with sand.

The following additional observation of *a Centauri* was made last night:—

	P. Angle.	Weight.
1877.	°	
Aug. 14	80° 42'	4

The weather shows signs of improvement.

The observations recently secured would have been lost in Garrison.

I trust the Society will find it possible to convey their thanks to Captain Phillimore for his great and successful exertions on behalf of the expedition.

*The Observatory, Mars Bay,  
Ascension, August 15, 1877.*

*Second Report, dated September 4, 1877.*

By the mail which should leave September 5 (the day of *Mars'* opposition) I beg to forward the following report of the progress of the Society's Expedition.

In my last report I described the reasons which induced me

to dismantle the Observatory in Garrison and re-erect it on its present site.

The necessity for this step has been abundantly proved by the result, and whereas on very few occasions would measures of any kind have been possible in Garrison, a considerable number have been secured here.

The amount of cloud has been unusually great, and this has made the labour of watching very excessive.

By dint of constant watching *Mars* has been observed since August 10 whenever visible between  $20^{\circ}$  and  $75^{\circ}$  zenith distance, except on two occasions, when the definition was unsatisfactory and it was not thought advisable to make observations.

Both these occasions were in the evening, and observations in satisfactory atmospheric conditions were secured at a later hour. The accompanying table will give a pretty accurate idea of the observations secured. Only those are entered which are satisfactory and complete, and capable of being used in a parallax determination.

The definition, with the exceptions above mentioned, has been exceedingly steady and sharp, and the conditions of temperature are even more satisfactory than I had anticipated.

The table attached gives the reading of the external thermometer before and after each set of evening and morning observations, and it will be seen on examination that not only is the temperature range between evening and morning confined to a little more than  $1^{\circ}$  F., but the extreme range throughout the whole series is less than  $3^{\circ}$  F. Though the observations are so arranged that a difference in temperature between the evening and morning observations can produce no systematic error in the final result, yet there is no doubt that this remarkable uniformity will tend to diminish the final probable error.

The Observatories and dwelling tents are now connected by good paths, and these and the patches of volcanic dust have been covered by rough-grained sand (particles of shell) from the beach. The supply of food and provisions has been systematically arranged. Thanks to the tents in store from the Ashantee Expedition, our tent accommodation is excellent, and generally, as to comfort and health, all is as well as need be. The ample time observations (generally made by day) are reduced, and their results, together with duplicates of the heliometer observations for preservation, will be forwarded by next mail. For the past few days there has been but little of the usual trade-wind, and the island has been covered by nearly continual cloud during the night; thus no observations have been possible during the important period since August 31, except during a break in the cloud for two hours on the evening of September 2. This change causes me much anxiety, occurring as it does at so critical a juncture. I earnestly trust the weather may prove favourable during the remaining half of the opposition, and that I may thus be able to report the entire success of the expedition.



The accompanying photographs will illustrate the arrangement of the Observatory.

*Mars Bay, Ascension Island,  
September 4, 1877.*

*Third Report, dated October 5, 1877.*

I am happy to report the success of the *Mars* observations, or at least their success so far as it is possible to judge without complete reduction.

Satisfactory observations have been secured on 32 evenings and 25 mornings, during which series the distance of the planet has been measured from 22 different stars of comparison, the whole embracing 327 complete measures of distance, of which 194 belong to the evening and 133 to the morning observations. A *complete measure* involves four bisections, eliminating index error and planet diameter, so that 1,408 bisections will be employed in the complete discussion of the observations. The rainy season, which I feared (as stated in my last report), actually set in, and entirely prevented observations from September 11 to September 15, and indeed more or less from September 11 to the end of the month, but most fortunately was preceded by exceptionally fine weather during the important period September 4 to September 11.

This latter period was of extreme importance, because—

- 1° September 5 was the day of opposition, and the planet also passed within 2' of arc of the comparison star *g*. A very long series of this important appulse was obtained.
- 2° During the period September 5 to 11 the parallax was near its maximum, and also the planet was always nearly in the line joining the comparison stars *e* and *g*. This pair of stars has been used as the standard distance in the triangulation, and is therefore the best determined distance in the triangulation; the position angle of the line joining these stars differs only 5° from 90°, the direction of maximum diurnal displacement.
- 3° The position angle of greatest phase was during this period nearly at right angles to the direction *e-g*, and the maximum phase was very small; hence, along the line *e-g* the limbs were actually without phase.

For my own part I would willingly have undertaken the labour and anxiety of the expedition for the chances of this opportunity alone, and in its successful issue I hope the Society will not regret their liberality in promoting the expedition.

By this mail I send:

1. A copy of all the observations of *Mars*, with a short explanatory preface; this for preservation in the event of any accident to myself or to the original observations.

2. An account of the time determinations and definitive table of their results.
3. An account of the chronometers and discussion of the definitive daily error of the observing chronometer, with table of this error for every day of the *Mars* observations.
4. Observations for errors of the micrometer screw.
5. A note on the geographical position of the Observatory at Mars Bay.

By next mail I hope to send a complete copy of the observations made in triangulating the stars of comparison, together with a chart showing the plan of the triangulation.

The following Observatories have promised co-operation in the work of making meridian observations of the comparison stars :—

Greenwich.

Paris.

Pulkowa.

Several German Observatories, through Dr. Auwers.

Cordoba (Dr. Gould).

Cambridge, Mass.

Ann Arbor, Michigan (also extra-meridian observations).

Mr. Hartnup has also promised extra-meridian observations at Liverpool.

I have also sent lists of the comparison stars and requests for co-operation to the following Observatories, from which no replies have as yet been received :—

Washington.

Cape of Good Hope.

\*Melbourne.

Sydney.

Lord Lindsay has also promised observations at Dun Echt, so far as these will not interfere with the declination observations of *Mars*, and Dr. Ball at Dublin has also promised co-operation, conditionally on the state of health of his assistant Mr. Benton.

I hope that the result of these observations, combined with the heliometric triangulation, will give places of the comparison stars accurate to 1-10th of a second of arc at least, so that the differential equations resulting from the measures of distance may all be combined, neglecting the errors of the star places.

I regret that my last report (now enclosed) by an unfortu-

\* *Sept.* 10, 1877.—Since the above Report was written, the mail has arrived, bringing a letter from Mr. Ellery, to say that the *Mars* comparison stars will be observed at the Melbourne Observatory.

mate combination of circumstances missed the last mail, together with the rest of my month's correspondence. This accident is the more to be regretted, that some requests for special observations will, I fear, be too late now to be attended to so fully as I feel sure they would otherwise have been.

My health has somewhat suffered from the prolonged strain of the past two months, and I propose to-morrow to go "up the mountain" for a week's holiday and cool fresh air, and then to return to the completion of the triangulation of the *Mars* stars of comparison and the observations of *Melpomene*, when I hope the present period of cloudy weather will be past.\*

*Mars Bay, Ascension Island,  
October 5, 1877.*

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*On the Inferences for the Value of Mean Solar Parallax and other Elements deducible from the Telescopic Observations of the Transit of Venus, 1874, December 8, which were made in the British Expedition for the Observation of that Transit.* By Sir G. B. Airy, K.C.B., Astronomer Royal.

The Society are aware that, in response to a question in the House of Commons, a Report of the results as to the value of the Mean Solar Parallax derived from the telescopic observations made in the British Expedition for observing the late Transit of *Venus* was prepared and printed in the past summer, and is now on sale with other parliamentary documents. Although all important points were fully treated in that Report, several minor matters were necessarily deferred; some which, in the first instance, did not present themselves for consideration; and some which, under pressure of time, it was difficult to examine. I propose, in the present Paper, to supplement the Parliamentary Paper; to describe the process there pursued up to the point of treatment of equations, omitting, however, the somewhat voluminous details; and to resume the equations and to treat them in what appears to be the legitimate form; presenting the results which, I think, necessarily follow from the British telescopic observations. At some future time, I trust, these observations, and these reductions (with any variations which time may suggest) in a more orderly form, and with the additional inferences to be derived from the photographic operations, will be printed under the auspices of the British Government.

Acting as official superintendent, and under official responsibility, I have examined and approved every part of the operation. But I am bound to state that the most important discrimination of classes of observations, the scrutiny of individual observations, the organisation of an efficient computing staff, and

\* The statements of the observations of *Mars* which form part of these Reports are printed p. 17 *et seq.*—ED.